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NRO REVIEW COMPLETED

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21 May 1963

MEMORANDUM FOR THE RECORD

SUBJECT : OXCART Air Inlet Control System

1. [redacted] visited Headquarters 20 May 1963 to review subject inlet control system status. The following paragraphs summarize their comments.

2. Twenty one inlet control systems have been delivered. Eight of these are at [redacted] for retrofit and repair leaving thirteen in the field. Two of these thirteen delivered last week incorporate the latest "F" cam recontoured for improved installed automatic operation. Short range promises for additional controls with the "T" cam are four by 31 May plus six by 30 June.

3. Spike instability encountered on flights 12 and 13 of aircraft 122 has been isolated to two additive causes:

- a) Controls installed for these flights incorporated the older "E" cam, the characteristic of which permitted marginal stability of the spike at Mach numbers from 1.5 to 1.8.
- b) The spike actuator hydraulic oil metering valve seals deteriorated because of improper assembly at [redacted]. This resulted in severe hydraulic pressure fluctuations similar to household plumbing "water hammer".

Delivery of the "F" cam should eliminate the first cause. Revised assembly procedures and rework of field units should eliminate the second cause. As additional assurance against instability, new units will incorporate actuator valves with a lower gain or response rate although this is not considered the crux of the problem.

4. In order to improve and thereby permit bypass door automatic operation, the following corrections have been incorporated in current flight units:

- a) Relocated inlet positions of input sensory signals to bypass door control for a more accurate representation of existing inlet conditions.

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- b) Corrected pneumatic leak in system.

A new potential bypass door system problem, the definition of which depends upon additional flight experience may be too high a response rate of the system relative to the installation.

5. Clarification given in response to Headquarters' questions concerning quality of hardware and performance as delivered to the field is as follows:

- a) "Did [REDACTED] deliver a spike control with a scored actuator rod"? No. This actuator rod was scored in the field by application of excessive seal preload by [REDACTED] personnel.
- b) "Did [REDACTED] deliver a seized shock expulsion servo"? No. This servo seized after four hours of operation on test rig at Burbank. It is felt that water contaminated oil in the test rig caused the seizure.
- c) "Are the three major system components, the main control, the spike control, and the bypass door control so delicate that they must be used in matched sets rather than being interchangeable"? No. They are interchangeable.
- d) "Why the apparent spike induced hydraulic pressure fluctuation and spike actuator leak on flight 64 of aircraft 121 on 17 May"? Preliminary assessment is that spike schedule was set too close to the inlet unstart region prior to flight. This, with attendant yawing of aircraft caused unstart and spike to cycle from aft cruise to full forward to obtain restart, then to aft cruise, then with yaw again, causing unstart to full forward to obtain restart and so on. The actuator leak was due to broken actuator seals probably resulting from exceeding design loads with full forward spike excursions (cantilevered load) during aircraft roughness.

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- e) "Is the aircraft provided instrumentation in terms of quantity and accuracy sufficient for satisfactory operation and problem definition"?
No. Greater quantity and accuracy of inlet pressures is required. For example, based on flight experience, a plot of spike position versus inlet pressure ratio indicates complete lack of correlation while a plot of spike position versus Mach number provided by the air data computer indicates close correlation.

[redacted] was requested to check with Pratt & Whitney on the recently added instrumentation for the airflow match problem, particularly the 40 inlet pressure readings at the engine face. It was further emphasized that [redacted] should emphatically re-state their instrumentation requirements to Lockheed, and to Mr. Johnson personally via the message channel provided.

6. In summary, [redacted] emphasized the point that the inlet control system in general is doing what it is being told to do within the limits established by the preset schedule imposed prior to flight.

SIGNED

[redacted]
Development Division
(Special Activities)

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[redacted] DD/OSA [redacted] (22 May 1963)

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